Universität Zürich[UZH]

CCRS Center for Corporate Responsibility and Sustainability at the University of Zurich

CCRS Working Paper Series
Working Paper No. 02/13

Voluntary corporate climate initiatives and regulatory loom: Batten down the hatches

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October 2013

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October 22, 2013

Abstract

King and Lenox (2001) argued that "when does it pay to be green" might be a more important question for firms than whether it pays at all. We present an event study that suggests that it pays in the tangible presence of regulatory pressure, depending on how well the chosen scheme to become green fits with the threatened regulatory design. To this end, we exploit the unexpected passage of the Waxman-Markey Bill in 2009. This bill came as a surprise and brought the US economy on the brink of a nationwide CO_2 emission trading system. We use this event to study whether firms with memberships in two well-known voluntary environmental programs to curb carbon emission, the Chicago Climate Exchange and the Climate Leaders, were rewarded by the stock market when the likelihood of federal legislation targeting carbon emissions suddenly increased. To complement the picture, we examine the prior market response to membership announcements. As yet, empirical

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Acknowledgment: With great pleasure we acknowledge the helpful comments of Esther Blanco and Filippo Lechthaler. We highly appreciate that Beat Hintermann disclosed the dataset he and Will Gans used for their study. We are also thankful for interesting discussions with the participants of the: RESEC Seminar at ETH Zurich, Swiss Society of Economics and Statistics conference, European Association of Environmental and Resourece Economist conference and with the sub-theme Sustainable Development and Financial Markets at the European Group for Organizational Studies colloquium.

evidence on both issues does not present a coherent picture. We unravel the intricacies by standardizing the statistical methods and integrating the datasets. Our results suggest that only membership in tailored programs is considered beneficial. Crucially, a substantial part of the market reaction consists of industry-wide effects. In contrast to previous findings, we find no evidence that mere membership announcements triggers a market reaction. Our findings shed light on investors' expectations of climate change policies and their value perception of voluntary carbon reduction programs.

1 Introduction

The latest assessment report of the Intergovernmental Panel on Climate Change once again stresses the critical impact of CO_2 emissions on the environment. Still, it does not seem likely that an agreement on a global framework to tackle climate change is achieved anytime soon. Notably the United States as the leading nation in greenhouse gas emissions lacks federal legislations that address carbon emissions on firm level. [1] Neither did any signs credibly point into that direction until 26 June 2009, when the US House of Representatives narrowly passed H.R. 2454: The "American Clean Energy and Security Act of 2009". Dubbed the Waxman-Markey Bill, this act aimed to cap CO_2 emissions in the US by means of an emission trading system. The passage of this bill caught the public off guard. Even though the Senate eventually defeated the bill later on, its success in the House of Representatives unexpectedly and substantially increased the likelihood of federal carbon legislation in the US.

Some firms seemed prepared in light of this looming change in legislation. Apart from signaling credibility and commitment, voluntary (but nevertheless binding) environmental initiatives provide a learning environment to improve one's corporate footprint. With the goal to curb CO_2 emissions in the US, two initiatives launched in the early 2000s stand out. The Climate Leaders (CL) program was an industry-government partnership to help firms reduce emissions of six major greenhouse gases. Participating members pledged to a realistic reduction goal within a five to ten year timeframe. The second initiative could be considered a direct predecessor of the government-based emission trading system intended by the Waxman-Markey Bill. The so-called Chicago Climate Exchange (CCX) was a trade platform for CO_2 certificates. Its members agreed to a reduction goal and independent verification of their efforts.

Against this background, this paper addresses two questions. First, it asks whether being prepared for CO_2 regulation pays off for firms. More precisely, we employ an event study to analyze whether corporate membership in the CCX or CL initiative was immediately rewarded by the financial markets in view of the unanticipated rise of likelihood of federal legislation. If this is the case, one motivation for firms to join such voluntary programs might be preparation for regulation. On that note, Bruce Braine, vice president of strategic policy analysis for American Electric Power described the motivation to participate in the CCX as follows: "Many of us were doing this not only to make voluntary commitments, but as a way that we could get prepared for a mandatory future. [...] We were learning the ropes, learning about trading and trying to become more proficient in reducing our carbon footprint over time." We are not the first to exploit this event. A similar study by Gans and Hintermann (2013) comes to the conclusion that, evaluated on a monthly basis, the passage of the Waxman-Markey Bill was associated

[1] There are regional efforts, e.g.: California has recently introduced a cap-and-trade program. However, the large number of allocated pollution permits weigh heavy on their price. Other initiatives encompass several states. The Regional Greenhouse Gas Initiative aims to reduce greenhouse gases in nine US states in the northeast and is limited to large fossil fuel power plants.

with positive returns for CCX firms. [2]

The second question this paper tackles is how, if at all, the mere announcement to join a voluntary environmental initiative is gaged by the stock market. Existing empirical evidence is ambiguous. Fisher-Vanden and Thorburn's (2011) event study analyzes the immediate stock market reactions for firms announncing their membership to the CL program. In the seeming absence of regulatory pressure, these firms were vigorously penalized in terms of falling stock prices. These results give reason to believe that engagement in voluntary programs are perceived as detrimental from an investor's point of view. On the other hand, investors might perceive voluntary carbon reduction programs as a fitting training ground for an expected mandatory carbon market. In this case, stock market reactions in light of an abrupt increase in the likelihood of legislation should be favorable. Other empirical evidence is consistent with this view. In their study, Gans and Hintermann (2013) come to the conclusion that the stock market reacted favorably towards firms announcing membership to the CCX.

At first glance, this contradicting evidence seems puzzling. We argue that the ambiguity hinges on two issues. For one, test statistics of short-horizon event studies (like the one in Fisher-Vanden and Thorburn) are better specified than those of long-horizon event studies because they are less sensitive to the benchmark model of normal returns and issues of cross-sectional or time-series dependence of abnormal returns (Kothari and Warner, 2007). Gans and Hintermann (2013) employ a difference-in-differences framework on a monthly basis when evaluating the effects of membership announcements and the Waxman-Markey Bill on CCX firms. Their results are highly instructive, but the approach is rather unusual in the context of unexpected events. The large time window associated with monthly data and particularly the lack of consideration for confounding events gives pause. Brown and Warner (1980), for instance, document the problem of using monthly data by illustrating that the degree of misspecification in event tests can be severe. And in a well-known replication study, McWilliams and Siegel (1997) highlight the importance of accounting for such confoundings. In other words, it is not clear to what extent the identified positive return effect for the CCX firms in Gans and Hintermann is attributable to the two events in question, the membership announcements and the Waxman-Markey Bill. By the same token, it would be illuminating to know how CL firms, in addition to their negative reaction upon membership announcement, fared during the passing of the Waxman-Markey Bill. The structure of the CCX program differs substantially from the CL initiative and relies heavily on a market mechanism to curb CO_2 emissions. Does the conflicting evidence on membership announcements for the CCX and the CL initiative translate to the Waxman-Markey Bill? A comparison of the two programs in light of the Bill would yield complementary evidence about the value perception of voluntary initiatives in critical times.

This paper reconciles the existing findings and contributes to a more comprehensive picture. We fill two explanatory gaps and highlight the role of industry-wide effects . First, we add to the conclusiveness of the statistical inference on the effects of both membership announcement and

[2]National Geographic, daily news, November 3 2010

the Waxman-Markey Bill on CCX members. The surprising nature of these events lends itself exceptionally well to conducting an event study. Our second contribution consists in the direct comparison of two distinct initiatives for both events. To this end, we extend the analysis of the impact of the Waxman-Markey Bill to CL firms. This extension yields complementary evidence to the preparation argument. Since the market deemed the value of becoming a member in these two programs differently, we might also observe disparate market reactions in light of the Waxman-Markey Bill. In particular, an environmental program that is tailored to the specific threat of future regulation by means of a cap-and-trade system is likely to be a more effective tool to mediate the effect of an according shock. Put differently, we would expect the CCX cap-and-trade program to receive more goodwill from the market during the passage of the Bill.

Our results are in line with this argument. Conservative estimates suggest that stock prices of CCX members experienced on average positive abnormal returns of 0.7 percent during the passage of the Waxman-Markey Bill. CL members, on the other hand, hardly provoked any significant market reaction. Our analysis suggests that industry-wide market reactions play an important role when evaluating suddenly looming environmental costs. When analyzing the impact of the bill, it turns out that these industry effects explain a substantial part of the observed reaction for the CCX firms and fully absorb the effect that is otherwise attributable to CL membership. Finally, our event study finds no measurable market reaction for firms announcing membership to the CCX. This qualifies previous findings.

The rest of the paper is structured as follows. The next section provides background information on the Waxman-Markey Bill, the two voluntary environmental programs in our sample, and the related literature. Section 3 lays out the event study methodology, followed by the description of our data in Section 4. The results of the two event studies are presented in Section 5, and the last section concludes.

2 Background

2.1 Waxman-Markey

H.R. 2454, the "American Clean Energy and Security Act of 2009" was a bill to propose, among other things, the introduction of a cap and trade system. The bill, also known as the Waxman-Markey Bill, was to regulate the emission of greenhouse gases in the United States, in particular CO_2. Remaining the last industrialized country solely oriented towards voluntary programs, the bill was to replace existing voluntary action with mandatory legislation. Under the new legislation, over the next 40 years carbon emissions would be increasingly capped up to 83% of 2005 levels. Allocated with certain CO_2 allowances, the regulated firms would be free to trade their pollution rights at market prices. Although constituting the most prominent element of the legislation, the contents of the bill extend beyond the cap-and-trade system. It was a comprehensive policy to address climate change. As such, it included requirements of

"creating a combined energy efficiency and renewable electricity standard and requiring retail electricity suppliers to meet 20% of their demand through renewable electricity and electricity savings by 2020" and "setting a goal of, and requiring a strategic plan for, improving overall U.S. energy productivity by at least 2.5% per year by 2012 and maintaining that improvement rate through 2030".[3]

After months of negotiations, on Friday June 26 2009 at 7:17 p.m. the House of Representatives passed the bill by a vote of 219 to 212. The outcome remained uncertain to the end and stirred up subsequent emotions, pointing towards a controversial and unforeseen decision. The media response proclaimed the legislation as historic for the United States and a victory for the Obama administration. Although it remained to be seen whether the Senate would approve the bill as well, the decision in the House of Representatives left the country stunned and raised questions about the immediate impact on the economy. For some time, there was good reason to believe that firms would face substantial costs in terms of CO_2 reduction efforts in the near future.

2.2 Chicago Climate Exchange and Climate Leaders

Two major initiatives to curb greenhouse gas emissions in the US were launched roughly ten years ago. In 2003, the Chicago Climate Exchange (CCX) started trading operations of the first cap-and-trade system in North America with 13 charter members that made voluntary but legally binding commitments to reduce six different types of greenhouse gas emissions.[4] By definition, the exchange was characterized by a market mechanism, a platform where prices were considered and allowances exchanged, and where strategic interaction took place. As part of its cap-and-trade scheme the CCX relied on a carbon offset program with its own standards for allowances and offset credits, called "Carbon Financial Instrument" contracts. Established emission baselines and emission reports were verified independently. The CCX was characterized by two distinct phases. From 2003 to 2006 members had to cut their emissions annually by 1% bellow their baseline average defined as from 1998 to 2001. In the second phase from 2007 to 2010, existing members had to cut emissions annually by 0.5% while new members had to cut emissions by 1.5%.

The CCX was characterized by a comprehensive market structure with different participants. Apart from the direct emitters, the CCX members, there were associate members, offset providers, liquidity providers and exchange participants. Overall, the exchange had around 400 members with annual membership fees ranging from 1,000-60,000 USD[5], depending on firm size and membership type. In November 2010, the CCX announced that it would cease its operation, arguing that firms were no longer interested in trading emission credits in the ab-

[3] `http://www.govtrack.us/congress/bills/111/hr2454`, visited on October 9 2012

[4] CCX Fact Sheet, December 2011. `https://www.theice.com/publicdocs/ccx/CCX_Fact_Sheet.pdf`, visited on January 14 2013

[5] `http://co2offsetresearch.org/policy/CCX.html`, visited on December 20 2012

sence of government legislation (Financial Times). The low price of CO_2 emission allowances indicates that the firms' emission reduction targets were not very stringent and that therefore firms expected and indeed did over comply with their commitments. A further source of the cheap emission allowances might also be the criticized weak additionality requirement of CCX (Kollmuss et al., 2008).

The Climate Leaders Greenhouse Gas Inventory Protocol (CL) is the second voluntary initiative we study. Formed in 2002, the initiative was based on the Greenhouse Gas Protocol developed by the World Resources Institute and the World Business Council for Sustainable Development. The CL covered six major greenhouse gas emissions categorized into direct emissions (known as Scope 1), indirect emissions (known as Scope 2), and offered the reduction of optional emissions (known as Scope 3). Climate Leaders was an industry-government partnership initiated by the US Environmental Protection Agency (EPA) that worked with companies to develop comprehensive climate change strategies. Upon becoming a partner, the EPA assisted the company in developing inventory and inventory management plans. Partners then set a corporate-wide domestic or global five to ten year greenhouse gas reduction goal and reported annual inventory data to EPA. In addition, partners were to document their progress towards the goal (Tonkonogy and Oliva, 2007). Members did not only profit form EPA's technical assistance but EPA guaranteed also publicity for the members.

Four types of reduction goals were eligible for CL members: absolute, normalized, indexed, or carbon neutrality. Upon engagement, the EPA evaluated the proposed reduction goals from all partners, requiring an aggressive reduction compared to the projected GHG performance of the sector. Partners were also allowed to develop their own mitigation offset projects or purchase certified mandatory or voluntary GHG reductions, provided that the projects adhered to approved EPA methodologies. In contrast to the CCX, there were no explicit market mechanisms at work. Upon joining, it was not rational decision-making based on market prices that influenced the daily carbon business. According to the EPA, partners were sure to receive high level recognition via participating in meetings, public outreach, or press events (Tonkonogy and Oliva, 2007). On September 15 2010, the EPA announced their decision to shut down the program in light of new developments in regulatory and voluntary initiatives.

2.3 Related Literature

To an economist, voluntary participation in these two initiatives may seem puzzling at first glance. Traditional economic analysis assumes that firms already behave optimally, with pollution being an inevitable side product of production (Cropper and Oates, 1992). Reducing production voluntarily thus moves in lockstep with lower use of input, pushing the firm away from optimal production. Some critics, however, counter that it is questionable whether firms make optimal use of inputs in the first place and see room for improvement. This discussion has become popular as the "engergy efficiency gap". Allcott and Greenstone (2012) suggest

that the paradigm of efficient energy consumption does not seem too far-fetched, but their conclusion does not seem final (Nadel and Therese, 2012). In this sense, membership in voluntary initiatives might be helpful for optimal input allocation.

It turns out that one can explain voluntary participation in a number of other ways. The literature identifies a variety of rational motives, some of which are based on some sort of imperfect markets (for an overview, see Khanna, 2002). The motives can be roughly divided into market motives and political motives (Fleckinger and Glachant, 2011). Let us first discuss market motives.

Consumers with preferences for environmental friendly products may encourage product differentiation (Baron, 2001; Besley and Ghatak, 2007; McWilliams and Siegel, 2001). A firm can convey its inclination towards green consumers more credibly if it joins an initiative that verifies the according pledges independently. To this end, membership in voluntary initiatives could serve as a signaling device. The financial market could harbor another catalyst for green behavior. If there is pressure (or better yet, incentive) for green engagement from investors, some firms could be at an advantage. Acclaimed green firms in the limelight of green investors might benefit from lower capital costs caused by sub-optimal diversification (Heinkel et al., 2001; Merton, 1987). In turn, this benefit creates an incentive for polluting firms to go green (Baron, 2008). Disentangling the entity of the firm opens up the door to a different kind of benefit from membership in voluntary initiatives. From a corporate governance perspective, a firm might not seek to cater exclusively to its principals, the shareholders. Instead of acting in the interest of the principal, the firm's manager as the agent aims to maximize his or her own utility function. Tirole (2001) highlights this crucial relationship between shareholder interest and managerial incentive. These mismatched interests can explain green ventures if the manager draws particular utility from doing so, say, by improving his personal status. Yet other market motives include cost-cutting (Allcott and Greenstone, 2012; Bloom et al., 2010) or attracting particularly apt employees (Brekke and Nyborg, 2008).

Political motives constitute the second branch of reasons to go green. Lyon and Maxwell (2003) purport that that by participating in voluntary environmental initiatives, firms seek to pre-empt or shape future public policies. On this note, perhaps the most pertinent argument that rationalizes voluntary participation in our analysis is preparation for some expected legislation. There might be reason to believe that with a non-negligible probability, future environmental legislation will impose costly regulation upon firms. If so, it is reasonable to dampen the impact of such a future shock by adjusting the behavior today and prepare voluntarily. For a smooth path towards the expected extent of the regulation entails lower overall costs than a sudden adjustment. In contrast, then, to the corporate governance argument, voluntary green engagement is consistent with shareholder value maximization. Unexpected changes in legislation open up a possibility to test this hypothesis. If the markets correctly interprets the impact of suddenly looming legislation, we should observe immediate changes in certain stock prices, plausibly with some firms being affected more than others.

There is empirical evidence that supports the view that a sudden increase in the likelihood of future regulation is taken into account by the market. For instance, Bowen et al. (1983) and Hill and Schneeweis (1983) suggest that the nuclear incident at the Three Mile Island facility in 1979 affected the investors' perception of future regulation by resulting in a sudden drop in share prices for electric utility firms, in particular those who were invested in nuclear power. The chemical disaster in Bhopal in 1984 had a similar effect. Once the extent of the tragedy became clear, the market seemingly anticipated tighter regulation for the entire chemical industry (Blacconiere and Patten, 1994). Unexpected policy changes are likely to affect shareholder value as well. The sudden proposal by President George Bush in 1989 to revise the Clean Air Act triggered a drop in share prices for notoriously polluting firms (Freedman and Patten, 2004). And very recently, the unexpected reaction of the German government to the Fukushima incident affected energy companies' shareholder wealth (Betzer et al., 2013).

By and large, it is fair to assume that anticipated regulation is considered an impending threat by the market. Yet some firms seem to fare better in harsh times. There is reason to believe that voluntary engagement and subsequent verified disclosure is rewarded by the market because of the informational value it delivers when actually facing external shocks. For example, (more extensively) disclosing firms were at an advantage after the chemical leak in Bhopal (Blacconiere and Patten, 1994). The same held true after the sudden legislation in the US in 1986 to handle contaminated sites (Blacconiere and Northcut, 1997). And firms that were part of the Carbon Disclosure Project experienced an increase in shareholder value when Russia unexpectedly ratified the Kyoto Protocol in 2004 (Kim and Lyon, 2011). Much like the Waxman-Markey Bill, these events qualify as external shocks which increased the likelihood for environmental regulation.

There are two studies that address the value of membership in voluntary environmental initiatives and which are directly related to our paper. The event study by Fisher-Vanden and Thorburn (2011) investigates the announcement effects for firms joining the Climate Leaders program as well as the more vaguely defined Coalition for Environmentally Responsible Economies (CERES). While Fisher-Vanden and Thorburn do not discover any significant market reaction for joining CERES, they find negative abnormal returns for announcing membership in the CL program. On the day of the announcement, stock market returns of respective firms performed one percent worse than expected. Moreover, announcing a binding CO_2 target incurred an additional penalty of 1.1 percent. One characteristic among the CL firms is consistent with the mentioned corporate government argument to go green. The data show that firms are more likely to join the CL program if they exhibit hostile shareholder governance. It therefore seems likely that the market associated the announcements with the managers' discretionary leeway, which was not in the firms' interests.

The second paper that directly relates to our work is the aforementioned study by Gans and Hintermann (2013). Gans and Hintermann investigate stock returns of member firms of the Chicago Climate Exchange on a monthly basis. Contrary to the CL firms in Fisher-Vanden and

Thorburn, they find significant positive abnormal returns for firms announcing their membership to the CCX. In addition, Gans and Hintermann take a look at the financial impact of the Waxman-Markey Bill on CCX firms and find a positive market reaction. There are methodological drawbacks, however. The large time frame makes it difficult to isolate the effect of the Waxman-Markey Bill. This issue is exacerbated by the fact that the impact of the Waxman-Markey Bill was not screened for confounding events at the firm level during the same time frame. We address these issues and extend their analysis. Our paper follows the event study methodology applied in Fisher-Vanden and Thorburn and provides comprehensive results of the impacts of membership announcement for CCX firms on the one hand and the Waxman-Markey Bill for both CCX and CL firms on the other hand. In doing so, the results benefit from higher explanatory power. The next section briefly exposits the event study methodology and highlights its advantage for causal inference.

3 Methodology

Event studies have become an indispensable tool in econometrics. MacKinlay (1997) gives a comprehensive overview of the history, theory, and application of event studies in economics. Event studies use financial market information (often stock prices) to deduce the effect of a specific event on the value of a firm. This approach has the advantage that the causal chain is isolated. The event has a direct impact on the stock price, similar to a treatment effect. The statistical inference in an event study relies on three assumptions (McWilliams and Siegel, 1997): Market efficiency, a lack of confounding effects during the event window, and underestimation or no anticipation of the event. Indeed, if the event in question was already anticipated and provided, investors would have already had priced in its predicted impact on firm value. While the passage of the Waxman-Markey Bill was not out of the question, there is empirical evidence that it was indeed largely unexpected and provided the market with new information (Meng, 2013).

The measurement of the impact is carried out by calculating the so-called abnormal stock return. The abnormal return (AR) is the observed return minus the normal return during a specified event window, where the normal return is the return that one would expect to occur if the event had not taken place. The abnormal return $AR_{i\tau}$ is given by equation 1, where $E(R_{i\tau}|X_\tau)$ is the expectation of return $R_{i\tau}$ given X_τ.

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|X_\tau) \tag{1}$$

In financial economics, the normal return is often modeled via the market model, which relates the return of interest $R_{i\tau}$ to the market return $R_{m\tau}$. In a nutshell, the market model isolates the fraction of the return that is associated with the market return, rendering the return

of interest more informative. The parameter estimates of the market model are calculated in an Ordinary Least Square framework on the basis of a preceding estimation window. In addition to the market return, our specification additionally employs the Fama-French's "small minus big" (SMB) and "high minus low" (HML) factors on a daily basis as explanatory variables (Fama and French, 1992, 1993). Kolari and Pynnonen (2010) illustrate that this specification achieves the highest reduction of residual cross-correlation. Taken together, we estimate the following model specifications:

$$R_{i\tau} = \alpha_i + \beta_{i1} \cdot R_{m\tau} + \beta_{i1} \cdot SMB\tau + \beta_{i2} \cdot HML\tau + \epsilon_{i\tau} \quad (2)$$

$$R_{i\tau} = \alpha_i + \beta_{1i} \cdot R_{m\tau} + \beta_{2i} \cdot SMB_t + \beta_{3i} \cdot HML + \beta_{4i} \cdot ESret_{jt} + \epsilon_{i\tau} \quad (3)$$

$$R_{i\tau} = \alpha_i + \beta_{1i} \cdot R_{m\tau} + \beta_{2i} \cdot SMB_t + \beta_{3i} \cdot HML + \beta_{4i} \cdot BSret_{\gamma t} + \epsilon_{i\tau} \quad (4)$$

SMB In equation 2 denotes the daily difference of a portfolio of small and big firms, and HML indicates the daily difference of a portfolio of low and high book to market value firms. [6] $\epsilon_{i\tau}$ is the remaining error term after estimating $E(R_{i\tau}|X_\tau)$ and follows from $\epsilon_{i\tau} = AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|X_\tau)$ via equation 1. We call the model specified in equation 2 the 3 factor model or the baseline specification. We extend this specification by adding industry return factors $ESret_{jt}$ and $BSret_{\gamma t}$ in equation 3 and 4 respectively to control for industry effects. In $ESret_{jt}$, j denotes one of 10 economic sectors and in $BUSret_{\gamma t}$, γ denotes one of 25 business sectors according to the Thomson Reuters Business Classification.

The event takes place after the estimation window and is usually placed inside the so-called event window, during which the observed returns are compared to the expected ones. Because some events cannot be unambiguously dated, for example due to gradual information leakage or potential insider information, researchers often include several days around the official date $\tau = 0$. However, this comes at a cost. A longer time series of $AR_{i\tau}$ diminishes the power of the test statistics and tends to increase the number of confounding events. Not to mention that a longer event window is difficult to reconcile with the notion of market efficiency. Contrary to long-horizon event studies, the test statistics of short-horizon event studies are generally less sensitive to the benchmark model of normal returns and issues of both cross-sectional and time-series dependence of abnormal returns (Kothari and Warner, 2007).

In our data, $R_{i\tau}$ is the total return index based on closing prices. The closing price of day $\tau - 1$ is the opening price of day τ. In the event window notation $[T_2, T_3]$, T_2 referres to the opening price on day τ_o and T_3 to the closing price on day τ. The event window $[1, 1]$ therefore captures the return on the day after the event day $\tau = 0$. We are interested in two events, membership announcements and the Waxman-Markey Bill. We define the Waxman-Markey event day, Friday 26 June 2009, as $\tau = 0$ and set the estimation window to 60 trading days from

[6] Downloaded from Kenneth French's website: `http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html`

$T_0 = -59$ to $T_1 = 0$. The event day $\tau = 0$ is included in this estimation window because of two reasons: First, the vote took place at 7pm and therefore after the closing of the stock exchanges. Second, the issue of potential information leakage can be excluded because the outcome of the vote was extremely narrow and the public outcry thereafter was substantial. The event window $[1, 1]$ is set narrowly after the event and captures the abnormal returns on day one after the event with $T_2 = 1$ and $T_3 = 1$. A second, longer windows estimates the returns over $[1, 2]$ until $\tau = 2$. We do not consider longer event windows because the event precedes the weekend, which should provide enough time for the news to spread. For the second event in question, the CCX membership announcments, we extend these narrow windows. It is arguable that the announcements have experienced prior information leakage. To ease the direct comparison with Fisher-Vanden and Thorburn (2011) we choose the following event windows: $[0, 1]$, $[-1, 1]$, and $[-2, 2]$. Setting the estimation window to 60 days sets a span from $T_0 = -62$ to $T_1 = -3$. In turn, the cross-sectional abnormal returns $AR_{i\tau}$ in the event window are cumulated from T_2 until T_3. This yields the cumulative abnormal returns $CAR_{i[T_2,T_3]} = \sum_{\tau=T_2}^{T_3} AR_{i\tau}$. By averaging the CARs across the observations, n average CARs are obtained: $ACAR_{[T_2,T_3]} = \frac{1}{n}\sum_{i=1}^{n} CAR_{i[T_2,T_3]}$.

The raw returns are useful for economic interpretations. Standardized returns, however, have been proven to exhibit better statistical properties (Patell, 1976). The scaled abnormal returns are equal to $SAR_{i\tau} = \frac{AR_{i\tau}}{S(AR_i)}$, where the sampling error correction is given by $S(AR_i) = \sqrt{\sigma^2_{\epsilon_i} * [1 + x'_t(X'X)^{-1}x_t]}$. The SARs can be cumulated over time as well: $CSAR_{i[T_2,T_3]} = \sum_{\tau=T_2}^{T_3} SAR_{i\tau}$. The cross secional means of these cumulated standardized abnormal returs are equal to $ASCAR_{[T_2,T_3]} = \frac{1}{n}\sum_{i=1}^{n} CSAR_{i[T_2,T_3]}$.

In comparison to a conventional t-test or Patell's test, the test proposed by Boehmer et al. (1991) given in equation 5 is robust towards event induced variance inflation. Harrington and Shrider (2013) show that the presence of heterogeneous effects induces event variance and robust tests against cross-sectional variation in the true abnormal return should therefore be preferred.

$$t_{BMP} = \frac{ACSAR \cdot \sqrt{n}}{\frac{1}{n-1}\sum_{i=1}^{n}(CSAR_i - ACSAR)^2} \tag{5}$$

An issue for the Waxman-Markey sample is clustering since the event affects all sample firms simultaneously in time. One might therefore question that $\epsilon_{i\tau}$ is independent and identically distributed. MacKinlay (1997) suggests that clustering can be accommodated in two ways. Either by a portfolio approach which allows for cross correlation of the abnormal returns, or by analyzing the abnormal returns without aggregation, e.g. by including a dummy for the event day. The latter approach has two drawbacks. The test will generally suffer from poor finite sample properties and has little power against reasonable alternatives. As a remedy, Kolari and Pynnonen (2010) propose a modification of the test statistic developed by Boehmer et al. (1991)

that is not affected by clustering. Kolari and Pynnonen's statistic increases the cross sectional variance used by Boehmer et al. (1991) by adjusting for the average covariance of the error terms $\bar{\rho}$ during the estimation window:

$$t_{KP} = t_{BMP}\sqrt{\frac{1-\bar{\rho}}{1+(n-1)\bar{\rho}}} \tag{6}$$

We consider the Kolari and Pynnonen (2010) test statistic to be the most appropriate for our samples. In addition, we make use of the non-parametric generalized rank test proposed in Kolari et al. (2010) to check the robustness of our parametric tests. We choose the generalized rank test because it has better properties for testing CARs than the conventional rank test and is equally well suited for testing single day abnormal returns.

4 Data

In this section, we analyze the announcement effect of the Waxman-Markey bill on both CCX and CL members. In addition, we investigate whether firms announcing CCX membership experience positive abnormal returns in an event study. Gans and Hintermann have kindly provided us with their CCX database and data on their selection process. [7] Their final sample for the Waxman-Markey event consists of 32 firms. We have compiled roughly the same number. We start with the same database with 109 members. Of these, 20 are government-affiliated and are cities, states, or universities. From the remaining 89 observations, we find listings for 57 firms in the US. From these listings we drop seven firms with discontinuous price indices, a sign of illiquid securities. From the remaining 53 firms, seven are American Depositary Receipts and three are not major listings or have their book values not denominated in USD. This leaves us with 40 identified CCX member firms.

We complement our database for the Waxman-Markey event with CL firms and their partnership status. Fisher-Vanden and Thorburn identify the announcement effect of firms joining CL (and CERES). In contrast, we identify the effect of the Waxman-Markey Bill on existing CL members. Our database starts with the listed CL members retrieved from the US Environmental Protection Agency as of 8 May 2009.[8]Of the 264 members at this point in time, we focus on the 19 achiever and 87 setter firms. The other 158 so-called developer firms are by definition at a very early stage of their membership. We question their status being an advantage in light of the Waxman-Markey Bill. Indeed, the majority of the developer firms later on opted out of the program, questioning their motivation and commitment in the first place. We exclude these

[7]Their CCX sample is from 2010, but we found a document form February 2009 that lists the same CCX members: `http://www.epa.gov/agstar/documents/workshop09/mccomb.pdf`, visited on December 10 2012.

[8]Obtained through www.archive.org on November 6 2012 via `web.archive.org/web/20090508120744/http://epa.gov/climateleaders/partners/index.html`

developer firms from our analysis because they presumably just started to consider the impact of their environmental footprint. What is more, this mitigates the concern that these firms might have joined CL in order to free-ride on the program's credibility (Darnall and Carmin, 2005).[9] Although we lack detailed membership status for the day of the passage of the Waxman-Markey Bill, Table 5 illustrates the development of the CL program over time. Note in particular the change in the number of firms across all membership categories from 8 May 2009 to 1 August 2010.

Of the 106 Climate Leaders with setter and achiever status, we identify 65 as being listed on a US stock market. Among these stocks, there are five illiquid equity return indices and three ADR listings. This yields an identified sample of 57 CL firms.

The first row in Table 6 lists the identified firms for both programs. For the Waxman-Markey event samples we conducted a comprehensive analysis of confounding events for an event window from 26 June 2009 (Friday) through 30 June 2009 (Tuesday). For each firm in our database, we searched LexisNexis for unexpected announcements that were published in major US news outlets and which were likely to affect market value during the event window. The second row in Table 6 lists the number of confounding events for each program. For the 57 CL firms, we identify 16 confounding events, leaving us with a final CL sample of 41 firms. For the 40 firms in the CCX sample we identify confounding events for nine firms, leaving us with a final CCX sample of 31 firms. An overview of our final samples for the Waxman-Markey event are given in Tables 8 and 7. Table 8 lists the final CL sample with the according membership status and whether the respective firms were charter partners. In addition, the geographic reach of the emission reductions are shown. Table 7 lists our final CCX sample and indicates charter member status where applicable. The tables also show that six firms were members in both programs.

In addition to the Waxman-Markey event samples, we are interested in the announcement effect for CCX member firms. To determine this sample we start with the same CCX database and apply the same filters. For the identified firms we search both Google and LexisNexis for membership announcements, resulting in the sample of 26 firms shown in Table 6. In contrast to the Waxman-Markey Bill we cumulate abnormal returns for larger event windows due to potential information leakage. Accordingly, we search for confounding events up to two days prior and two days after each membership announcement. We find six confounding events and end up with a sample of 20 firms.

5 Results

This section presents the results of two distinct events. First, we investigate the market reaction to the Waxman-Markey Bill for our three firm samples described in the last section: A CCX

[9] urlhttp://www.epa.gov/climateleadership/documents/partners_letter_15sep2010.pdf, visited on December 9 2012

sample, a CL sample, and a pooled sample of all firms combined. Second, we take a look at the market reaction to membership announcement for CCX firms, offering a direct comparison to the same reaction towards CL firms in Fisher-Vanden and Thorburn (2011). Taken together, these two events paint a coherent picture of the stock market assessment of the value of membership in voluntary initiatives, both in critical and less critical times.

Table 1: Descriptive Statistics

	CL & CCX	**CCX**	**CL**
Number of firms	60	31	41
Market value (MV, billion USD)			
Mean MV	18.1	17.7	24.1
Median MV	6.7	4.8	11.1
Total sales (billion USD)			
Mean sales	20.8	23.2	23.1
Median sales	10.3	9.3	14.4
Market-to-book equity (MEBE)			
Mean MEBE	1.9	2.1	2.0
Median MEBE	2.0	1.3	2.3
Fraction of sample firms in TRBC sector:*			
Basic Materials	0.18	0.32	0.07
Consumer Cyclicals	0.15	0.06	0.20
Consumer Non-Cyclicals	0.05	0.00	0.07
Financials	0.02	0.03	0.02
Healthcare	0.05	0.03	0.07
Industrials	0.15	0.13	0.17
Technology	0.22	0.13	0.29
Utilities	0.18	0.29	0.10

*TRBC: Thomson Reuters Business Classification.

Market value (MV) of equity 7 trading days before June 29 2009.

The mnemonic of sales is WC01001 and of book equity WC03501

5.1 Event Returns: Waxman-Markey Bill

Table 1 presents descriptive statistics for the three samples. The pooled sample comprises 61 firms. On their own, the CCX sample consists of 31 firms and the CL sample 41 contains firms, meaning that six firms are members in both programs. The distribution of the market capitalization is positively skewed for the CCX and the CL samples, with CL members being substantially bigger. The two samples differ in the distribution of their sale volumes as well. Although CL firms have, on average, the same turnover as CCX firms, their median is higher. A similar skew is visible in market-to-book numbers. While the average of market-to book equity is the same in both samples, the medians indicate a proclivity for value firms in the CCX sample and for growth firms in the CL sample. The two samples differ in the industry exposure as well. Two economic sectors as classified by the Thomson Reuters Industry Classification are absent from our samples: Telecommunications and Energy. The other economic sectors are not equally distributed, neither across the CL nor the CCX sample. For example, the CCX sample harbors a larger fraction of basic materials and utilities, whereas the CL sample shows a tilt towards technology firms.

We conduct estimates of abnormal returns for all three samples. To allow for value-relevant information to distribute and sink in, we conduct analyses for two event windows after the passage of the bill. Based on the market model given by equation 2 we calculate the cumulated abnormal returns CAR[1,1] for Monday 30 June only and CAR[1,2] for the two trading days after the event.

Table 2 presents the abnormal returns and their derivatives according to the 3 factor model, our baseline specification. The results for the event windows [1,1] and [1,2] are depicted in panels A and B, respectively. Across all samples, the average cumulated abnormal returns (ACAR) for the short event window are close to 0.5%. The median of the CAR is larger throughout, most notably for the CCX sample. In contrast, their standardized counterparts (CSAR) are substantially lower with means close to the medians. Of the three samples, the CCX firms exhibit the highest standardized returns. The two-sided test statistic by BMP Boehmer et al. (1991) is highly significant across the board. The null hypothesis of normal returns is well rejected at the 0.1% significance level for the CCX firms and only slighty more so for the CL firms. As expected, the more conservative KP p-values according to Kolari and Pynnonen (2010) are higher (roughly 3% for the CCX firms and 7.6% for CL firms). Finally, the nonparametric generalized rank test supports the rejection of the null hypothesis of normal returns for the short event window.

The cumulated abnormal returns over two days in panel B indicate a negative skew for CL and the pooled sample, whereas the mean and median CARs of the CCX sample are robust and over 0.7%. This suggests that the market incorporated additional price information on the second day after the event. The BMP statistic remains significant across the samples for this longer event window, for the CCX firms once again at the 0.1% level and less so for the CL

firms at the 10% level. The KP p-values, however, only remain significant for the CCX and the pooled sample. Put differently, a conservative estimation suggests that the CL firms do not seem to exhibit abnormal returns when cumulated over two days. Again, the generalized rank test dovetails with the KP test.

Taken together, these results are consistent with the idea that financial markets believe that firms engaging in voluntary measures of carbon emission reduction get a head start in preparing for imminent federal carbon emission legislation. But not all programs encounter equal praise. Based on the results of the market model, membership in the CCX is considered more beneficial in light of the Waxman-Markey Bill compared to membership in the CL program.

All the same, the heterogeneous sector distributions for the CCX and CL firms give pause. The empirical evidence listed in Section 2 suggests that some sectors might experience specific shocks when faced with a carbon cap-and-trade system, depending on their cost exposure. Indeed, the CL and CCX firms are not readily comparable in terms of sector distribution. The results in Table 2 are based on the 3 factor model, which benchmarks a firm's returns against the market return and the two Fama-French risk factors SMB and HML. As such, the results are prone to industry-specific effects.

It seems plausible that the Waxman-Markey Bill had distinct effects in different industries. In order to isolate the CCX and CL membership effect, we proceed with controlling for industry-specific confoundings by extending the market model with both economic and, to reach an even deeper level, business sector returns. . In a first step, we incorporate industry return factors from 10 economic sectors. More precisely, for each security i in sector j we add to the market model the economic sector return j as defined in equation 3. Table 9 in the appendix summarizes the results of this extension. It turns out that economic sector returns explain a substantial part of the observed positive effects. By any measure of statistical significance and for both event windows, the abnormal returns of the pooled sample are no longer different from zero. The two samples on their own present a more nuanced picture. In the previous analysis, the CL sample only showed significant returns for the short event window. This significance disappears with the inclusion of industry-specific effects. The CCX sample, on the other hand, keeps showing (slightly less) significant abnormal returns, in particular for the longer event window. In this window, the CARs and CSARS for the CCX firms are somewhat reduced by introducing industry-specific controls. In sum, the new results indicate that positive sectoral effects have been at work, much more so for the CL than for the CCX sample. The effect for the CCX firms dilutes in the pooled sample.

To further check the robustness of these results, we extend the market model by adding to each security i in business sector γ the business sector return γ. In contrast to 10 economic sectors, we are thus now able to differentiate more subtly by controlling for 25 business sectors. The results for our third and most strict specification, which is formally given by equation 4, are presented in Table 3. The results reinforce the trend set by the previous specification with 10 economic sectors. In addition to the CL sample, the CCX sample starts losing some of its

Table 2: 3 factor model

	CL&CCX	CCX	CL
Panel A: event window[1,1]			
ACAR	0.450	0.437	0.476
CAR Median	0.534	0.740	0.490
ACSAR	0.264	0.324	0.230
CSAR Median	0.241	0.303	0.220
BMP t-statistic	3.403	2.960	2.533
BMP p-val	0.001	0.006	0.015
KP t-statistic	2.298	2.280	1.820
KP p-val	0.025	0.030	0.076
GRank Test	2.745	2.605	2.248
GRank p-val	0.008	0.012	0.028
Nr. of Observations	60	31	41
Panel B: event window[1,2]			
ACAR	0.310	0.789	0.347
CAR Median	0.734	0.766	0.723
ACSAR	0.375	0.540	0.275
CSAR Median	0.393	0.503	0.503
BMP t-statistic	2.937	3.087	1.924
BMP p-val	0.005	0.004	0.061
KP t-statistic	1.983	2.378	1.383
KP p-val	0.052	0.024	0.174
GRank Test	2.105	2.354	1.619
GRank p-val	0.040	0.022	0.111
Nr. of Observations	60	31	41

CAR & CSAR in %. 60 days estimation window from 02apr2009 to 26jun2009. Event window[1,1] captures the abnormal returns on day 26jun2009 and event window[1,2] on 26jun2009 and 30jun2009. The BMP test (Boehmer et al. 1991) is an extension of Patell (1976) and robust to event induced variance. The KP test (Kolary & Pynnönen, 2010) is adjusting the BMP test for cross sectional correlation. In our samples the average correlation of abnormal returns $\bar{\rho}$ is: $\bar{\rho}_{cl\&ccx}$ = 0.020, $\bar{\rho}_{ccx}$ = 0.022 , $\bar{\rho}_{cl}$ = 0.023 . The non-parametric GRank test is the generalized rank test for cumulated returns from Kolari and Pynnönen (2010a.)

verve. While there remains evidence of abnormal returns for the longer event window in panel B, controlling for business sectors renders the statistical significance of abnormal returns in the short event window non-significant.

Let us take a closer look at the longer event window for the CCX sample in Table 3. The CARs are positively skewed, with a substantially higher mean than median value. This holds true for the standardized CARs as well. The previous specifications have shown consistently lower p-values for the BMP test in comparison to the KP test. This order has now switched. While the BMP test statistic implies a p-value above the 10% level, the stricter KP p-value retains statistical significance at this level. This switch can be explained by the average correlation of the abnormal returns $\bar{\rho}$, which has become slightly negative. The significance of the KP p-value is supported by the generalized rank test. The analysis suggests that business sector effects explain an additional part of the positive abnormal returns. Further indication that controlling for sectoral effects has increased the explanatory power is reflected by the changes in correlation of the abnormal returns $\bar{\rho}$ (see the footnotes in the according tables). This value decreases steadily with increasingly detailed model specification and tends to converge towards zero. In sum, CCX firms seem to have profited from the threat of regulation in addition to being overrepresented in favorable sectors.

5.2 Event Returns: CCX membership announcement

As the second event, we investigate the market reaction to CCX membership announcements. The sample consists of 20 firms announcing their engagement, ranging from the founding members in 2003 up to the last announcements in 2008. Industry-specific effects are less of a concern in this setting. While the Waxman-Markey Bill has shown to have had a sudden and highly focused impact on entire industry sectors at one point in time, mere membership announcements should hardly be confounded by industry-wide effects. Moreover, they are scattered over several years. In contrast to the Waxman-Markey Bill, however, information leakage poses a potential problem. To address the possibility that insider information affected the stock price before the firms' public statements, we extend the event window symmetrically around the announcement dates. In addition to calculating the cumulated abnormal returns over the short window [0,1], we add two longer windows, [-1,1] and [-2,2] to ease the comparison with Fisher-Vanden and Thorburn.

Table 4 presents the abnormal return estimates for CCX membership announcement. Over the short window, both the ACAR and the ACSAR are slightly positive. This changes when expanding the event windows, with the longest window exhibiting negative returns across the board. However, none of the results show a statistically significant pattern. All test statistics are well below significance levels and cannot reject the null hypothesis of normal returns in light of the membership announcements. In yet other words, the market was seemingly indifferent to the firms' sudden voluntary engagement in the CCX. Our results qualify the findings in Gans

Table 3: 4 factor business sector model

	CL&CCX	CCX	CL
Panel A: event window[1,1]			
ACAR	-0.196	-0.260	-0.063
CAR Median	-0.109	-0.042	-0.071
ACSAR	0.029	0.082	0.021
CSAR Median	-0.069	-0.036	-0.039
BMP t-statistic	0.345	0.694	0.213
BMP p-val	0.731	0.493	0.832
KP t-statistic	0.345	0.712	0.199
KP p-val	0.731	0.482	0.844
GRank Test	0.516	0.644	0.577
GRank p-val	0.608	0.522	0.566
Nr. of Observations	60	31	41
Panel B: event window[1,2]			
ACAR	0.259	0.684	0.270
CAR Median	-0.055	0.170	0.096
ACSAR	0.127	0.303	0.074
CSAR Median	-0.016	0.063	0.046
BMP t-statistic	0.962	1.679	0.507
BMP p-val	0.340	0.103	0.615
KP t-statistic	0.964	1.722	0.472
KP p-val	0.339	0.095	0.639
GRank Test	1.005	1.674	0.815
GRank p-val	0.319	0.100	0.419
Nr. of Observations	60	31	41

CAR & CSAR in %. 60 days estimation window from 02apr2009 to 26jun2009. Event window[1,1] captures the abnormal returns on day 26jun2009 and event window[1,2] on 26jun2009 and 30jun2009. The BMP test (Boehmer et al. 1991) is an extension of Patell (1976) and robust to event induced variance. The KP test (Kolary & Pynnönen, 2010) is adjusting the BMP test for cross sectional correlation. In our samples the average correlation of abnormal returns $\bar{\rho}$ is: $\bar{\rho}_{cl\&ccx}$ = -0.000, $\bar{\rho}_{ccx}$ = -0.002 , $\bar{\rho}_{cl}$ = 0.004 . The non-parametric GRank test is the generalized rank test for cumulated returns from Kolari and Pynnönen (2010a.)

and Hintermann, where a positive market reaction was concluded. Nevertheless, CCX firms seem to provoke a different market reaction upon membership announcement than CL firms do. In Fisher-Vanden and Thorburn, newly announced membership engagement in the CL initiative was vigorously punished with negative abnormal returns.

Table 4: 3 event windows based on the 3 factor model

	[0,1]	**[-1,1]**	**[-2,2]**
ACAR	0.150	-0.213	-0.513
CAR Median	0.210	-0.001	-0.310
ACSAR	0.185	0.168	-0.024
CSAR Median	0.135	-0.013	-0.117
Patell t-statistic	0.813	0.738	-0.107
Patell p-val	0.420	0.464	0.915
BMP t-statistic	0.517	0.319	-0.043
BMP p-val	0.607	0.751	0.966
KP t-statistic	0.455	0.281	-0.038
KP p-val	0.651	0.780	0.970
GRank Test	0.897	0.454	0.011
GRank p-val	0.374	0.651	0.991
Nr. of Observations	20	20	20

CAR & CSAR in %. The 3 factor model parameters are estimated during 59. The BMP test (Boehmer et al. 1991) is an extension of Patell (1976), robust to event induced variance. Kolary & Pyönnen (2010) (KP) extend the BMP test, adjusting for cross sectional correlation. The average correlation of abnormal returns $\bar{\rho}$ in our sample is $\bar{\rho} = 0.015$ The GRank test is the generalized rank test for cumulated abnormal returns from Kolari and Pyonnen (2010a)

6 Conclusion

When does it pay to be green? This paper studies two events to answer this question. First, we examine the immediate effect of the Waxman-Markey Bill on stock prices for members of two voluntary but binding US environmental initiatives, Climate Leaders (CL) and the Chicago Climate Exchange (CCX). This bill intended to establish a mandated carbon market in the US and unexpectedly passed the vote in the House of Representatives in June 2009, temporarily inducing a credible economic threat in the form of unforeseen costs in the short run. In the second event study, we investigate the market reaction to membership announcements to the CCX.

Our event studies employ the market model augmented by the Fama-French factors (Fama and French, 1992, 1993). In our baseline specification, the reaction to the Waxman-Markey Bill indicates positive abnormal returns for both the CL and the CCX firm samples. However, the existing literature stresses that industry effects may play a role in the attributed impact on firm level. With respect to the Waxman-Markey event in particular, the implementation of the bill would likely have had specific impacts on different industries. For this reason, we isolate the membership effect in a voluntary climate initiative by extending the basic model specification by economic and, on a deeper level, business sector returns. Doing so puts the positive effects into perspective. By and large, members of the Chicago Climate Exchange seemed to profit from the Waxman-Markey Bill despite the confounding industry effects. This finding is in line with Gans and Hintermann (2013), but the observed industry effects dampen the attributed market reaction to CCX membership. On the other hand, the industry effects fully account for the positive returns for the Climate Leaders.

In a second event study, we investigate the market reaction towards membership announcement. In their event study, Fisher-Vanden and Thorburn found significant negative effects when new CL member announced their engagement. In direct comparison to the immediate negative reaction towards the CL announcements in Fisher-Vanden and Thorburn's event study, how do new CCX members fare? Our results for CCX membership announcement cannot reject a neutral market reaction and qualifies the conclusions of previous findings, where Gans and Hintermann concluded a positve reaction for CCX announcements. We attribute the distinct results in spite of the same event to the methodological differences. Our observed market reaction suggests that the market does not regard the CCX engagement as a detrimental venture. One could argue that the engagement was in line with the market's expectation of the firms' strategies. Obviously, both initiatives entail considerable costs for the firms in the short run. The reaction to the membership announcements suggest that the perceived advantages of membership only outweigh these costs in case of the engagement in the CCX. There only seemed good reason to join the CCX, not the CL initiative.

Taken together, the market reaction in light of the two events paint a consistent picture of the perceived value of membership in the two initiatives. The significant abnormal returns for the Chicago Climate Exchange members during the passage of the Waxman-Markey Bill are likely to be explained by the fact that this program effectively mirrored the workings of a regulatory cap-and-trade system as intended by the bill. Indeed, the CCX can plausibly be considered a blueprint for the emission trading system proposed in the bill. The positive reaction distinguishes the Chicago Climate Exchange from the Climate Leaders, who acquired firm internal knowledge about how to implement an emission management system and how to identify and pursue emission reduction opportunities. Crucially, the Climate Leaders did not profit from participating in an active carbon market, gaining trading experience and knowledge directly applicable in the foreseen cap-and-trade system. The indifferent market reaction for the Climate Leaders during the passage of the bill is in line with the preparation argument. These results are

also consistent with the view that firms do not only join to signal a credible commitment to go green, but gain actual experience which is helpful in light of looming regulation.

We caution to claim external validity for our results. Membership in these initiatives is voluntary and therefore endogenous. Even though we control for firm characteristics in our estimations, we can not control for variables like firm strategy or product differentiation. We would expect firms with higher membership payoffs to be more likely to join. By the same token, it seems reasonable that the observed market reaction for members establishes a upper bound when thinking about a contractual membership of non-member firms. On the other hand, one might argue that the Waxman-Markey event was a regulatory event and therefore less dichotomous as other events, the observed market reaction rather establishes a lower bound effect.

Based on our results of the two examined events we contend that voluntary initiative alone are clearly not enough to move the whole economy to a lower carbon intensity. But they might complement regulatory regimes. The results of this paper inform about the interaction of voluntary program design and regulation. Interestingly enough, even the Bush administration itself, under which the Climate Leaders program was initiated, did not really believe in the effectiveness of purely voluntary efforts. The New York Times wrote on January 20 2003 that administration officials were collecting written promises from industries to curb greenhouse gas emissions. "White House officials, insisting on concrete commitments measured in tons of gases, have rejected written offers from some industry groups to take nonspecific actions, several industry officials said.... Opponents of regulation have criticized the administration's effort as a mandatory program disguised as a voluntary one."

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7 Tables

Table 5: Climate Leader Membership Development

Date	**# Firms**	**Achievers**	**Setters**	**Developers**
28.03.2008	162	11	69	82
21.05.2008	172	11	69	92
03.01.2009	249	18	85	146
08.05.2009	264	19	87	158
01.08.2010 *	191	26	93	72
13.02.2011	183	32	100	51

* Retrieved on September 20 2012 from:

`http://www.epa.gov/climateleadership/documents/directory.pdf`

All other dates are from lists as retrieved from `www.archive.org`

Table 6: Nr. of firms in samples

	Waxman-Marekey event			Membership announcement
	CL&CCX	**CCX**	**CL**	**CCX**
Identified*	84	40	57	26
Confounding events	24	9	16	6
Resulting sample	60	31	41	20

* Identified firms without illiquid firms and ADRs.

Table 7: Chicago Climate Exchange firms (CCX) and event samples

Firm name	**Sample membership***		**Charter member**
Abbott Laboratories	MA		
Agrium U.S. Inc.		W&M	
Alliant Energy Corporate Services Inc.		W&M	
American Electric Power	MA	W&M	charter member
Avista Corporation	MA	W&M	
Bank of America Corporation		W&M	
Baxter International Inc.	MA	W&M	charter member
Boise Paper Holdings, LLC	MA	W&M	
CLECO Corporation		W&M	
Central Vermont Public Service	MA	W&M	
Dow Corning		W&M	
DTE Energy Inc	MA	W&M	
DuPont		W&M	charter member
Eastman Kodak Company		W&M	
FMC Corporation		W&M	
Ford Motor Company		W&M	charter member
Genon Energy Inco.	MA		
Green Mnt.Power Corp.	MA		
Intel Corporation	MA	W&M	
Interface, Inc.	MA	W&M	
IBM	MA	W&M	
International Paper		W&M	charter member
Knoll, Inc.	MA	W&M	
MeadWestvaco Corp.	MA	W&M	charter member
Mirant Corporation		W&M	
Motorola, Inc.		W&M	charter member
Neenah Paper Incorporated	MA	W&M	
Nrg Energy Inco.	MA		
Plum Creek Timber Company, Inc.		W&M	
PSEG Energy Resources & Trade LLC		W&M	
Puget Energy Inco.	MA		
Safeway Incorporated	MA		
Steelcase Inc.		W&M	
TECO Energy, Inc.		W&M	
Temple-Inland Inc	MA	W&M	charter member
United Technologies Corporation		W&M	
Waste Management, Inc.	MA	W&M	charter member

Sample membership*: - W&M; Waxman-Markey event sample
- MA; Membership Announcement sample.

Table 8: Sample of Climate Leader firms (CL) for Waxman-Markey event

Firm name	**CL status***	**Charter partner**	**Reduction region**
3M	achievers		U.S. GHG
Advanced Micro Devices, Inc.	achievers	charter partner	global GHG
Agilent Technologies	setters		global GHG
American Electric Power	achievers		U.S. GHG
Applied Materials, Inc.	setters		global GHG
Bank of America Corporation	setters		U.S. GHG
Baxter International Inc.	achievers	charter partner	U.S. GHG
Best Buy Co., Inc.	setters		U.S. GHG
Calpine	setters		U.S. GHG
Campbell Soup Company	setters		U.S. GHG
Caterpillar Inc.	achievers		global GHG
Cisco Systems, Inc.	setters		global GHG
Cummins Inc.	setters		global GHG
Dell Inc.	setters		global GHG
DuPont Company	setters		global GHG
Eastman Kodak Company	setters	charter partner	global GHG
Ecolab, Inc.	setters		U.S. GHG
EMC Corporation	setters		U.S. GHG
Fairchild Semiconductor	setters		U.S. GHG
Hasbro, Inc.	achievers	charter partner	U.S. GHG
Intel Corporation	setters		global GHG
Interface, Inc.	setters	charter partner	U.S. GHG
IBM Corporation	achievers	charter partner	global GHG
International Paper	setters	charter partner	U.S. GHG
Johnson Controls, Inc.	setters		U.S. GHG
LSI Corporation	setters		U.S. GHG
Marriott International, Inc.	setters		U.S. GHG
Merck & Co., Inc.	setters		global GHG
Millipore Corporation	setters		global GHG
Coors Brewing Company	setters		U.S. GHG
FPL Group, Inc.	achievers	charter partner	U.S. GHG
NVIDIA Corporation	setters		U.S. GHG
Owens Corning	setters		U.S. GHG
PepsiCo	setters		U.S. GHG
PPG Industries, Inc.	setters		global GHG
PSEG	setters	charter partner	U.S. GHG
Staples, Inc.	setters	charter partner	U.S. GHG
Steelcase Inc.	setters		U.S. GHG
Gap, Inc.	setters		U.S. GHG
United Technologies Corporation	achievers		global GHG
Xerox Corporation	achievers		global GHG

CL status*: Status of Climate Leader member with regard to emission reduction pledge.

Table 9: 4 factor economic sector model

	CL&CCX	CCX	CL
Panel A: event window[1,1]			
ACAR	-0.047	0.102	-0.082
CAR Median	0.027	0.181	-0.004
ACSAR	0.073	0.204	0.011
CSAR Median	0.018	0.114	-0.002
BMP t-statistic	0.896	1.829	0.118
BMP p-val	0.374	0.077	0.907
KP t-statistic	0.808	1.796	0.100
KP p-val	0.422	0.082	0.920
GRank Test	1.173	1.903	0.513
GRank p-val	0.245	0.062	0.610
Nr. of Observations	60	31	41
Panel B: event window[1,2]			
ACAR	0.276	0.717	0.294
CAR Median	0.465	0.804	0.380
ACSAR	0.185	0.436	0.063
CSAR Median	0.197	0.403	0.160
BMP t-statistic	1.423	2.479	0.432
BMP p-val	0.160	0.019	0.668
KP t-statistic	1.283	2.435	0.367
KP p-val	0.204	0.021	0.715
GRank Test	1.442	2.247	0.664
GRank p-val	0.155	0.028	0.509
Nr. of Observations	60	31	41

CAR & CSAR in %. 60 days estimation window from 02apr2009 to 26jun2009. Event window[1,1] captures the abnormal returns on day 26jun2009 and event window[1,2] on 26jun2009 and 30jun2009. The BMP test (Boehmer et al. 1991) is an extension of Patell (1976) and robust to event induced variance. The KP test (Kolary & Pynnönen, 2010) is adjusting the BMP test for cross sectional correlation. In our samples the average correlation of abnormal returns $\bar{\rho}$ is: $\bar{\rho}_{cl\&ccx}$ = 0.004, $\bar{\rho}_{ccx} = 0.001$, $\bar{\rho}_{cl} = 0.009$. The non-parametric GRank test is the generalized rank test for cumulated returns from Kolari and Pynnönen (2010a.)